IN MEMORIAM OF PROFESSOR P. K. BHATTACHARYA

BY GEORGE G. ROUSSAS & DEBASIS BHATTACHARYA

Professor Prodyot K. Bhattacharya, a faculty member of the Department of Statistics at the University of California, Davis (UC-Davis) since 1981, and Professor Emeritus since 1994, passed away in Davis on March 09, 2018.

P.K. Bhattacharya, or just P.K. as he has been known, was born in 1930 in Calcutta, India, and did all his university work in the University of Calcutta, being awarded his B.Sc. degree in 1951, his M.Sc. degree in 1953, and his Ph.D. degree in 1960. He was a research scholar in the Department of Statistics, University of Calcutta, for the period 1954-1960.

After receiving his Ph.D. degree, he served as a Research Associate at the University of North Carolina, Chapel Hill, and Stanford University; as a Reader at the Indian Statistical Institute, Calcutta; and as a Professor at the University of Arizona, Tucson, 1965–1980. During the latter period of time, he also served as a Visiting Professor at the University of Minnesota and the MIT, and as a Visiting Scholar at the Indian Statistical Institute, Calcutta.

P.K. joined the faculty at the UC-Davis in 1981, soon after an independent Statistics unit was established there. By that time, P.K. had under his belt more than twenty years of experience in teaching and research. These assets, along with his intrinsic keen-sightedness and strategic thinking, rendered him instrumental in helping the young statistics unit evolve into a unit of national and international reputation.

P.K.'s research interests span a wide spectrum of topics. Non-parametric methodology, asymptotic theory, various aspects of regression analysis, change point problems, sequential analysis, and stochastic processes theory have been areas, where P.K. contributed in a significant manner; in many cases, by devising ingenious tools and approaches. Although P.K. has been looked upon as a primarily theoretical researcher, it is somewhat surprising that he also contributed measurably to areas such as mathematical biology, cosmology-physics, and social processes, always in collaboration with specialists in those fields. This demonstrates his interest in applications, as well as his talent in fruitfully collaborating with non-statisticians.

More specifically, P.K. had a strong and lasting interest in non-parametric inference in various settings; some of his contributions to function estimation rise to the seminal level. Problems pertaining to regression analysis were also of central interest to him, and so were the change point problems. He contributed significantly to the classical problem of constructing admissible estimates for the mean of a k-variate Normal distribution when k is strictly larger than 2. Other research areas, where

P.K. made his mark are extreme-value problems, study of the probability ratio and its application to hypothesis testing, as well as obtaining admissible Bayes solutions to classification problems.

Examples of P.K.'s contribution to probability are his study of the problem of transforming stochastic processes into Brownian processes, and the representation of the infimum (in $[0, t]$) of certain additive processes, in the context of the detection of weak signals.

In mathematical biology, P.K. applied his theoretical ingenuity by introducing non-parametric Bayes inference in a biometric setting. In cosmology-physics, researchers were concerned with the solution of a very real problem, which—in statistical terms—amounts to non-parametric estimation of the slope in a linear regression problem when the response variable is truncated. P.K. provided an appropriate solution to this problem, and also supplied theoretical justification to existing heuristic methods.

Finally, in reference to control charts, P.K. constructed non-parametric versions, proposed rank-sign procedures, motivated by the lack of robustness of existing procedures when the parametric assumption is violated; and provided a rigorous treatment of the general asymptotic theory of the non-parametric procedures pertaining to control charts.

Despite his many and significant contributions to the statistical profession, P.K. remained a modest man. A number of years ago, his colleagues in the Department of Statistics at the UC-Davis thought that, as a token of appreciation to him, he should be honored with a special volume of contributed papers by colleagues and former students—a *Festschrift*. Its acceptance by P.K. was not automatic. Eventually this effort lead to the book *Nonparametric Statistical Methods and Related Topics: A Festschrift in Honor of Professor P.K. Bhattacharya on the Occasion of His 80th Birthday*; J. Jiang, G.G. Roussas, F.J. Samaniego, eds, World Scientific. 2012.

P.K.'s latest contribution to statistical literature- at the age of 86-has been the book *Theory and Methods of Statistics*, (jointly with Professor Parbir Burman), Academic Press, 2016.

Apart from his interest in statistics, he had an intense interest in Indian and Western classical music, and he was an avid reader of English and Bengali literature. He had a hobby of collecting high quality records of Indian and Western classical music. He had also a very keen interest in travelling; he travelled to almost all the continents. An interesting thing about P.K.'s travel was that he could recollect many minute details about the places he visited even after many years, when he was found in a story-telling mood to tell about his visits.

The underwriters were close to him, and deeply regret the loss of a colleague and dear friend. Furthermore, one of us had the pleasure and privilege of being associated with P.K. at the UC-Davis over a long period of time (since 1984), and for him, P.K.'s departure will be felt hard.

Professor P.K. Bhattacharya enriched the statistical science by his remarkably rich and creative ideas; he also stood as a role model of a humble and truly descent human being. The statistical community owes a debt of gratitude to him!

George G. Roussas is a Distinguished Professsor Emeritus at UC-Davis

Debasis Bhattacharya is a Professor of Statistics at Visva-Bharati University, Santiniketan